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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the matter of:	)	
	)	
Rulemaking to Permit	)	RM-8308
Use of the 76-77 GHz Band for	)	
Vehicle Radar Systems	)	

To: Office of the Secretary

Reply Comments of American Automobile Manufacturers Association

The American Automobile Manufacturers Association (AAMA) submits these reply comments in accordance with Public Notice DA 94-152. AAMA desires to clarify certain issues raised in other comments filed in response to DA 94-152. In addition, AAMA will elaborate on its justifications for the bandwidths requested in its earlier filed Comments.

In its Comments previously filed in this proceeding, AAMA proposed frequency bands and operational limits for vehicular radar systems. The proposal resulted from work done by AAMA Intelligent Vehicle Highway System (IVHS) Electromagnetic Spectrum Task Group which has spent the last year performing an ongoing investigation of spectrum needs for IVHS applications.

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The Task Group has endeavored to identify essentially all spectrum needs that are anticipated for vehicular radar systems. All known potential applications of vehicular radar systems were considered in developing a proposal that makes efficient use of spectrum and provides maximum potential for commercializing vehicular radar systems. Furthermore, the proposal strives to accomplish open entry for an unlimited number of manufacturers (original equipment manufacturers or OEM suppliers or aftermarket suppliers) of vehicular radar systems through particular frequency and bandwidth selections. Although the AAMA proposal meets the anticipated needs of its members, it is not the intent of AAMA to propose frequencies and operating limits just to satisfy the needs of its members. As stated in the previously filed Comments, AAMA is attempting to accommodate the unique requirements of all the separate types of vehicle radar that will provide public benefit.

Selection of the particular frequency bands requested in the AAMA proposal is dictated by functional requirements of vehicular radar applications having open entry and is not merely a reflection of current design and development efforts of AAMA members. The two primary bands in the AAMA proposal are the 76.5 GHz band and the approximately 94 GHz band. The 76.5 GHz band is under investigation by numerous regulating authorities, such as in Europe. Inclusion of this frequency is expected to provide international harmonization and improved market access for vehicular radar manufacturers. AAMA's request for a band within 92 to 95 GHz is motivated by "dual use" of components developed for military applications as well as by other factors set forth above.

Selection of other requested frequency bands is dictated, *inter alia*, by the particular functionality of anticipated applications including such factors as range, resolution, antenna size, and vehicle packaging. Furthermore, the AAMA proposal employs harmonic relationships between frequency bands to obtain hardware commonality and reduce system costs.[1] The 37.5 to 38.5 GHz band will facilitate rear and side radar detection for close-in

[1]Contrary to the assertion made in Supplemental Comments of VORAD Safety Systems, Inc., components are neither unavailable nor particularly expensive for the frequency bands requested under 100 GHz. See, for example, the description of a commercially available oscillator in "Broadband Gunn Fires 100 mW at 94 GHz", Microwaves & RF, February 1994, which is submitted herewith.

ranging at low power. It is a subharmonic of the 76 to 77 GHz band, thus allowing hardware commonality. The 152 to 154 GHz band is the second harmonic of the 76 to 77 GHz band, allowing hardware commonality even for vehicular radar systems needing better definition of obstacles for collision avoidance, needing smaller antenna size, or both. Likewise, the 139 to 141 GHz band could utilize currently available hardware for implementation with a slight detuning of components.

With respect to the suggestion in other comments that AAMA members are years away from commercializing vehicular radar systems, AAMA reaffirms that such systems are close to commercial realization.[2] It is vital that a comprehensive regulatory scheme be adopted in the near future to allow the public to benefit from vehicular radar systems.

Comments have been submitted suggesting that the Commission proceed with an allocation at one frequency (apparently for exclusive use by a single low volume supplier) while studying further the frequency bands of the AAMA proposal.[3] AAMA is in agreement with Rockwell International Corporation that "it is best to accomplish this task in a single rulemaking proceeding than to do it by a piecemeal approach, thus allowing development of the radar systems to proceed faster and with greater certainty."[4] The AAMA proposal is intended to provide frequency bands that will be adequate to satisfy all anticipated needs for vehicular radar systems. Failure to adopt comprehensive regulations

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[2]The "examples" cited by VORAD in its attempt to suggest that AAMA members are years away from commercial radar systems do not withstand scrutiny. Nearly a year has now passed since GM's quoted statement. The other cited example relates to collision avoidance radar, which is not expected to be deployed until after detection and warning systems.

[3]Supplemental Comments of VORAD Safety Systems, Inc., page 5.

[4]Comments of Rockwell International Corporation, page 2.

along the lines of the AAMA proposal would result in confusion for manufacturers and unnecessary delay for the public.[5]

Open entry of many different systems into the vehicular radar frequency bands is an important feature of the AAMA proposal, which accounts for the 1 and 2 GHz bandwidths requested. Use of these bandwidths would avoid mandating design requirements (such as modulation) which could inhibit technology development and improvements. Furthermore, these bandwidths would promote the use of low cost technology (by allowing sufficient space for some amount of frequency drift, for example).

Frequency coding is a technique likely to be used to circumvent interference between both like and unlike vehicle radar systems. Such modulation schemes require relatively wide transmit bandwidths. Bandwidths less than those requested by AAMA would limit use of such modulation schemes.

Typical transmit bandwidths for spread spectrum modulation at these frequencies are between about 200 and 400 MHz. In an open entry environment, it will be desirable that the number of unlike systems operating within the exact same bandwidth be minimized in order to further reduce the probability of interference. The requested 1 GHz bandwidths at 38 GHz, 76.5 GHz, and within the region from 92 to 95 GHz are only 2.5 times greater than the bandwidth of a typical radar system. Further, a 1 GHz bandwidth is consistent with the frequency band proposed in Europe.

It is anticipated that most forward looking radar systems will operate at the higher

[5]VORAD states that immediate allocation of spectrum under Part 15 of FCC Rules would promote near term availability of automotive devices. AAMA notes that existing Part 15 Rules do not address spectrum allocation above 40 GHz, that new rules are necessary. This is normally accomplished by a Petition for Rulemaking which has already been initiated by General Motors Research Corporation (see Petition to amend Part 15 Rules dated July 12, 1993), in anticipation of the development of their low power-near term radar system. The General Motors Petition has served as the catalyst to proceed with an overall rulemaking to address millimeter wave spectrum allocation needs. AAMA sees no reason for VORAD to be permitted to circumvent the very procedures that all interested parties are attempting to follow.

frequency bands (140 and 153 GHz) in the future as more vehicles will be introduced with these features. Thus, there will be a need to accommodate a greater number of users. A 2 GHz bandwidth is needed to ensure free access for vehicle radar applications and to preserve low likelihood of interference consistent with the potential safety benefits of these forward looking radar systems.

Accordingly, AAMA has proposed frequency bands and operational limits that are based on synergistic frequency relationships and that promote international harmonization of the electromagnetic spectrum, allow early manufacture of systems by utilizing available components, promote dual use between government and commercial industries, and permit open entry for all interested manufacturers. Therefore, AAMA requests that the FCC move forward on this important rulemaking.

Respectfully submitted,
AMERICAN AUTOMOBILE MANUFACTURERS ASSOCIATION

Date 3-4-94 by [signature]

Attachments (1) - Service List
(2) - Microwaves & RF, February 1994

Attachment 1

AMA SERVICE LIST - RM-8308

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ATTACHMENT

-40 to +80°C (140°F)
500 MHz shift typical

BROADBAND GUNN FIRES 100 mW AT 94 GHz

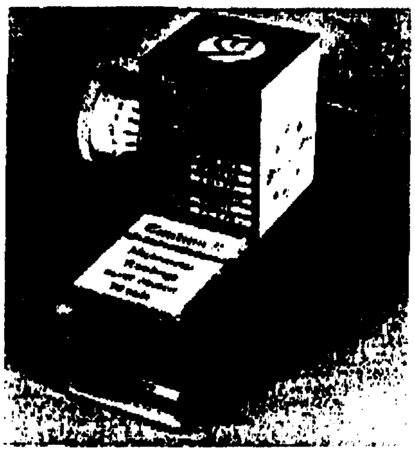
Automotive range is
-40 to +125

With a mechanical tuning range of 12 GHz, this InP oscill... provides high-output, low-noise, millimeter-wave signals.

LONG associated with mechanical tuning ranges of only a few percent at millimeter-wave frequencies, Gunn oscillators nonetheless deliver spectrally-pure signals for a wide range of applications. A new design from Epsilon Lambda Electronics Corp. (Geneva, IL), however, provides all the low-noise benefits of Gunn sources with a mechanical tuning range of 12 GHz at 94 GHz.

The model ELMB94/U Gunn oscillator (Fig. 1) provides 100-mW power across the tuning range and is an ideal replacement for reflex klystron tubes in W-band signal generators used in test applications. The solid-state oscillator offers considerably greater operating lifetime than the klystron with lower levels of noise. When equipped with the company's ELD101 frequency-modulation (FM)/amplitude-modulation (AM)-regulator power-supply unit, the Gunn oscillator operates as a simple bench-type signal generator

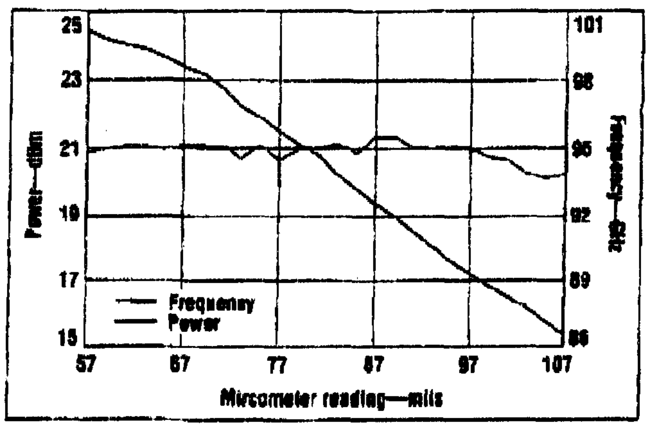
YONGHUI SHU, Design Engineer, Epsilon Lambda Electronics Corp., 427 Stevens St., Geneva, IL 60134; (708) 232-9611, FAX: (708) 232-9613.



1. The compact W-band Gunn oscillator is based on a high-performance diode and innovative cavity design.

for component, device, and system testing. The add-on unit simplifies oscillator bias and tuning while permitting broadband AM and FM.

The new oscillator combines a high-performance indium-ph... (InP) Gunn diode with a spec... signed cavity that yields an ... tionally-wide operating rang... affording high output pow... monotonic tuning charact... (the InP device technology is ... ularly noted for its robust ... capabilities at millimeter-wa... quencies). The diode is moun... full-height WR-10 waveguid... nel and operates in fundamen... quency mode. A resonant cap... the impedance match betwe... diode and the cavity. A bias ... provides voltage to the diode ... ferrite load mounted at the b... of the choke stabilizes the os... and absorbs any leakage po... waveguide non-conductin... backshort changes the effecti... onant frequency of the cavit... the wide tuning range. The ... cillator measures only 1.00 × ... 1.25 in. (2.54 × 2.54 × 3.18 c...



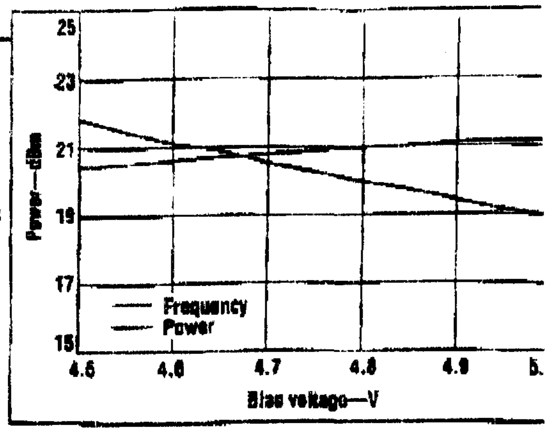
2. Tuning characteristics ... different micron... settings reveal ... linear output-po... response and fr... settability.

GUNN OSCILLATOR

Includes a micrometer driver for smooth and reliable frequency tuning from 88 to 100 GHz.

Typical tuning characteristics (Fig. 2) show how at least 100-mW output power is available across the full operating range. Output-power flatness varies less than ±1 dB across the 12-GHz tuning range. As

3. As much as ±100-MHz electrical tuning is possible with some sacrifice in output power.



is common with mechanically Gunn oscillators, higher o power levels are obtained at t per edge of the frequency ra and the ELMB94/U is no exce Maximum output power of 13 occurs from 94 to 100 GHz.

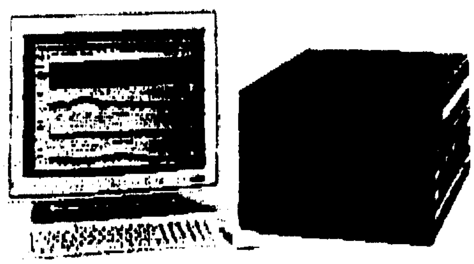
With approximately a 1-dB d available output power, bias t with +4.5 to +5.0 VDC can be ed over a ±100-MHz range (F This additional bias-tuning c teristic aids systems requiring as well as designers requirin increased frequency stabili phase-lock-loop (PLL) operati W-band.

The ELMB94/U W-band Gunn oscillator betrays little frequency instability from 0 to +60°C.

When tested at ambient temp tures from 0 to +60°C, the G oscillator betrays little freque instability. Typical frequency bility is -5 MHz/°C, while out power stability is -0.02 dB/°C. like many millimeter-wave desi the ELMB94/U is not a one-o kind but rather a production u All units in production offer tu characteristics within the ± MHz frequency and ±1-dB out power range. **Epsilon Lamb Electronics Corp., 427 Stev St., Geneva, IL 60134; (708) 2 9611, FAX: (708) 232-9613.**

CIRCLE NO

With the VP5000, we've done that for you.



Tackling a tough signal analysis problem no longer requires assembling a hodge-podge of oscilloscopes, spectrum analyzers, high-speed memories, snapshot recorders, processors, and specially-built items.

Now with one instrument – the VP5000 Wideband Signal Analysis System – you can capture, store, and play back signals, analog or digital, at up to 500 megasamples per second.

Because the VP5000 contains its own sophisticated computer and signal processor, you can perform practically any analysis function. Use our programs, or create your own with our development environment.

So, put away your wrenches and screwdrivers, and just contact us:

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Tel: 800.354.6195 Fax: 408.752.2379

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